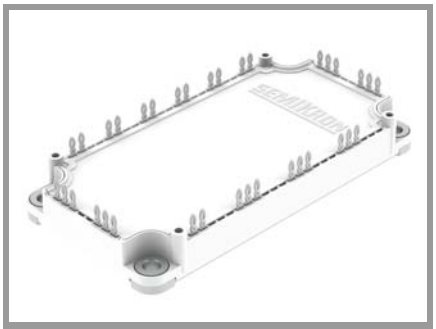
# SEMiX106GD12T4p



**SEMiX® 6p**

## Trench IGBT Modules

**SEMiX106GD12T4p**

### Features*

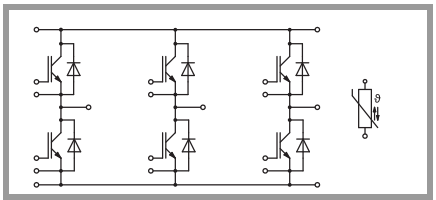
- Press Fit
- Homogeneous Si
- Trench = Trenchgate technology
- $V_{CE(sat)}$ with positive temperature coefficient
- High short circuit capability
- UL recognised file no. E63532

### Typical Applications

- AC inverter drives
- UPS
- Electronic Welding

### Remarks

- Case temperature limited to $T_C$=125°C max.
- $V_{isol}$ between temperature sensor and power section is only 2500V
- Product reliability results valid for $T_j \leq$ 150°C (recommended $T_{jop}$= -40 ... 150°C)



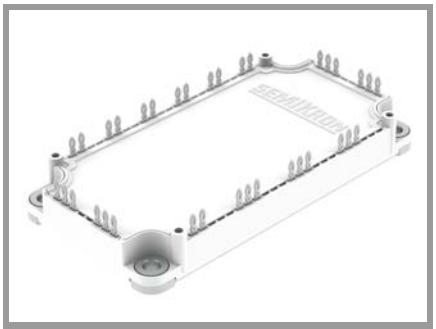
**GD**

**Absolute Maximum Ratings**

| Symbol | Conditions | | Values | Unit |
|---|---|---|---|---|
| **IGBT** | | | | |
| $V_{CES}$ | $T_j$ = 25 °C | | 1200 | V |
| $I_C$ | $T_j$ = 175 °C | $T_c$ = 25 °C | 167 | A |
| | | $T_c$ = 80 °C | 129 | A |
| $I_{Cnom}$ | | | 100 | A |
| $I_{CRM}$ | $I_{CRM}$ = 3 x $I_{Cnom}$ | | 300 | A |
| $V_{GES}$ | | | -20 ... 20 | V |
| $t_{psc}$ | $V_{CC}$ = 800 V<br>$V_{GE} \leq$ 20 V<br>$V_{CES} \leq$ 1200 V | $T_j$ = 150 °C | 10 | µs |
| $T_j$ | | | -40 ... 175 | °C |
| **Inverse diode** | | | | |
| $V_{RRM}$ | $T_j$ = 25 °C | | 1200 | V |
| $I_F$ | $T_j$ = 175 °C | $T_c$ = 25 °C | 121 | A |
| | | $T_c$ = 80 °C | 91 | A |
| $I_{Fnom}$ | | | 100 | A |
| $I_{FRM}$ | $I_{FRM}$ = 2x$I_{Fnom}$ | | 200 | A |
| $I_{FSM}$ | $t_p$ = 10 ms, sin 180°, $T_j$ = 25 °C | | 550 | A |
| $T_j$ | | | -40 ... 175 | °C |
| **Module** | | | | |
| $I_{t(RMS)}$ | per connector pin | | 50 | A |
| $T_{stg}$ | | | -40 ... 125 | °C |
| $V_{isol}$ | AC sinus 50Hz, t = 1 min | | 4000 | V |

**Characteristics**

| Symbol | Conditions | | min. | typ. | max. | Unit |
|---|---|---|---|---|---|---|
| **IGBT** | | | | | | |
| $V_{CE(sat)}$ | $I_C$ = 100 A<br>$V_{GE}$ = 15 V<br>chiplevel | $T_j$ = 25 °C | | 1.80 | 2.05 | V |
| | | $T_j$ = 150 °C | | 2.10 | 2.40 | V |
| $V_{CE0}$ | chiplevel | $T_j$ = 25 °C | | 0.8 | 0.9 | V |
| | | $T_j$ = 150 °C | | 0.7 | 0.8 | V |
| $r_{CE}$ | $V_{GE}$ = 15 V<br>chiplevel | $T_j$ = 25 °C | | 10.0 | 11.5 | mΩ |
| | | $T_j$ = 150 °C | | 14 | 16.0 | mΩ |
| $V_{GE(th)}$ | $V_{GE}$=$V_{CE}$, $I_C$ = 3.8 mA | | 5 | 5.8 | 6.5 | V |
| $I_{CES}$ | $V_{GE}$ = 0 V, $V_{CE}$ = 1200 V, $T_j$ = 25 °C | | | | 1 | mA |
| $C_{ies}$ | $V_{CE}$ = 25 V<br>$V_{GE}$ = 0 V | f = 1 MHz | | 6.2 | | nF |
| $C_{oes}$ | | f = 1 MHz | | 0.41 | | nF |
| $C_{res}$ | | f = 1 MHz | | 0.35 | | nF |
| $Q_G$ | $V_{GE}$ = - 8 V...+ 15 V | | | 565 | | nC |
| $R_{Gint}$ | $T_j$ = 25 °C | | | 7.5 | | Ω |
| $t_{d(on)}$ | $V_{CC}$ = 600 V | $T_j$ = 150 °C | | 150 | | ns |
| $t_r$ | $I_C$ = 100 A | $T_j$ = 150 °C | | 28 | | ns |
| $E_{on}$ | $V_{GE}$ = +15/-15 V<br>$R_{G\ on}$ = 1.6 Ω | $T_j$ = 150 °C | | 8 | | mJ |
| $t_{d(off)}$ | $R_{G\ off}$ = 1.6 Ω | $T_j$ = 150 °C | | 415 | | ns |
| $t_f$ | $di/dt_{on}$ = 3960 A/µs | $T_j$ = 150 °C | | 66 | | ns |
| $E_{off}$ | $di/dt_{off}$ = 1120 A/µs<br>dv/dt = 3300 V/µs<br>$L_s$ = 25 nH | $T_j$ = 150 °C | | 11.5 | | mJ |
| $R_{th(j-c)}$ | per IGBT | | | | 0.25 | K/W |
| $R_{th(c-s)}$ | per IGBT ($\lambda_{grease}$=0.81 W/(m*K)) | | | 0.06 | | K/W |



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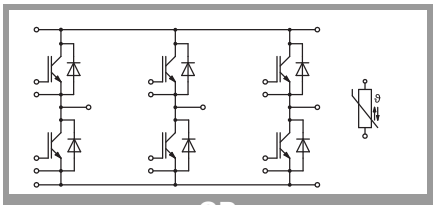
**Characteristics**

| Symbol | Conditions | | min. | typ. | max. | Unit |
|---|---|---|---|---|---|---|
| **Inverse diode** | | | | | | |
| $V_F = V_{EC}$ | $I_F$ = 100 A<br>$V_{GE}$ = 0 V<br>chiplevel | $T_j$ = 25 °C | | 2.20 | 2.52 | V |
| | | $T_j$ = 150 °C | | 2.20 | 2.47 | V |
| $V_{F0}$ | chiplevel | $T_j$ = 25 °C | | 1.3 | 1.50 | V |
| | | $T_j$ = 150 °C | | 0.90 | 1.10 | V |
| $r_F$ | chiplevel | $T_j$ = 25 °C | | 9.0 | 10 | mΩ |
| | | $T_j$ = 150 °C | | 13 | 14 | mΩ |
| $I_{RRM}$ | $I_F$ = 100 A<br>$di/dt_{off}$ = 4000 A/µs<br>$V_{GE}$ = -15 V<br>$V_{CC}$ = 600 V | $T_j$ = 150 °C | | 161 | | A |
| $Q_{rr}$ | | $T_j$ = 150 °C | | 16 | | µC |
| $E_{rr}$ | | $T_j$ = 150 °C | | 6.5 | | mJ |
| $R_{th(j-c)}$ | per diode | | | | 0.48 | K/W |
| $R_{th(c-s)}$ | per diode ($\lambda_{grease}$=0.81 W/(m*K)) | | | 0.08 | | K/W |
| **Module** | | | | | | |
| $L_{CE}$ | | | | 18 | | nH |
| $R_{CC'+EE'}$ | measured per switch | $T_C$ = 25 °C | | 1 | | mΩ |
| | | $T_C$ = 125 °C | | 1.4 | | mΩ |
| $R_{th(c-s)1}$ | calculated without thermal coupling ($\lambda_{grease}$=0.81 W/(m*K)) | | | 0.006 | | K/W |
| $R_{th(c-s)2}$ | including thermal coupling, $T_s$ underneath module ($\lambda_{grease}$=0.81 W/(m*K)) | | | 0.009 | | K/W |
| $M_s$ | to heat sink (M5) | | 3 | | 6 | Nm |
| $M_t$ | | | | - | | Nm |
| | | | | - | | Nm |
| w | | | | 300 | | g |
| **Temperature Sensor** | | | | | | |
| $R_{100}$ | $T_c$=100°C ($R_{25}$=5 kΩ) | | | 493 ± 5% | | Ω |
| $B_{100/125}$ | $R_{(T)}=R_{100}\exp[B_{100/125}(1/T-1/T_{100})]$; T[K]; | | | 3550<br>±2% | | K |



GD

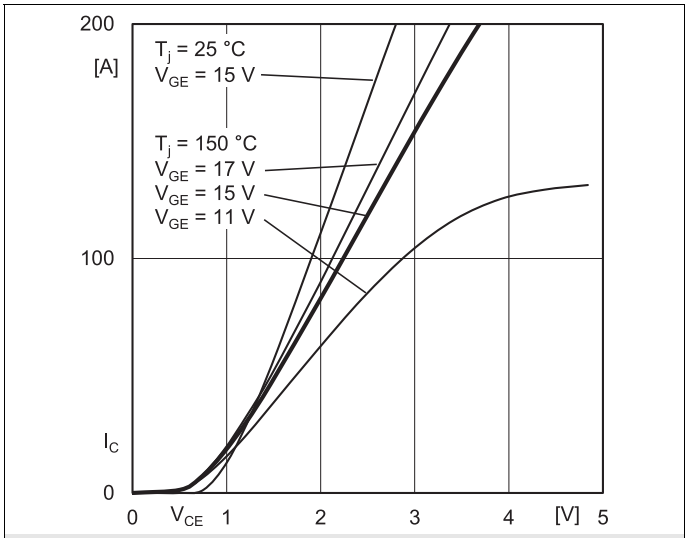



Fig. 1: Typ. output characteristic, inclusive $R_{CC'+EE'}$

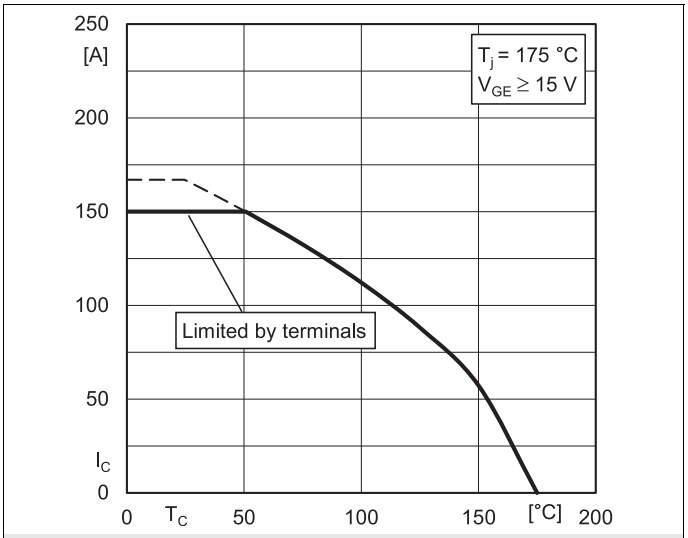



Fig. 2: Rated current vs. temperature $I_C = f(T_C)$

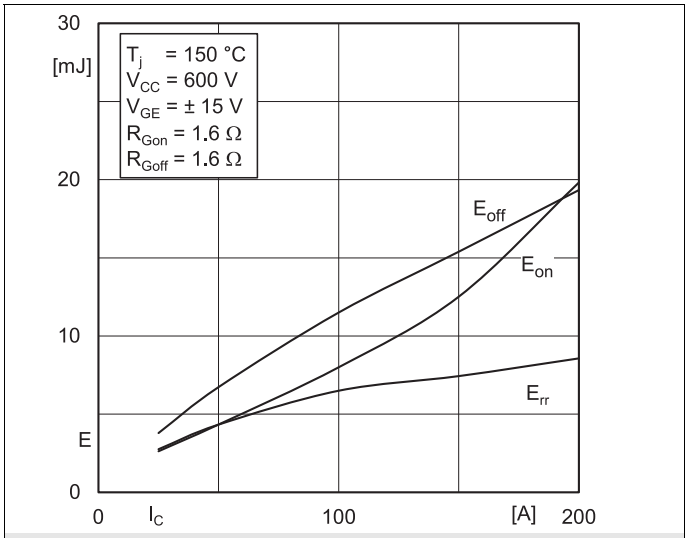



Fig. 3: Typ. turn-on /-off energy = f ($I_C$)

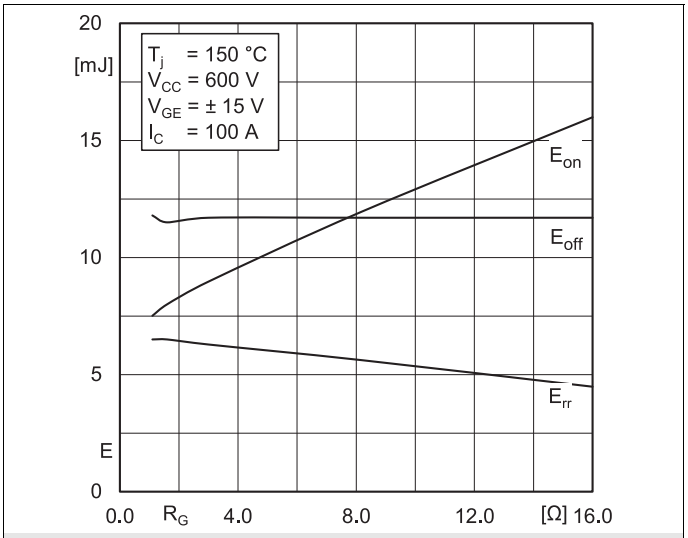



Fig. 4: Typ. turn-on /-off energy = f ($R_G$)

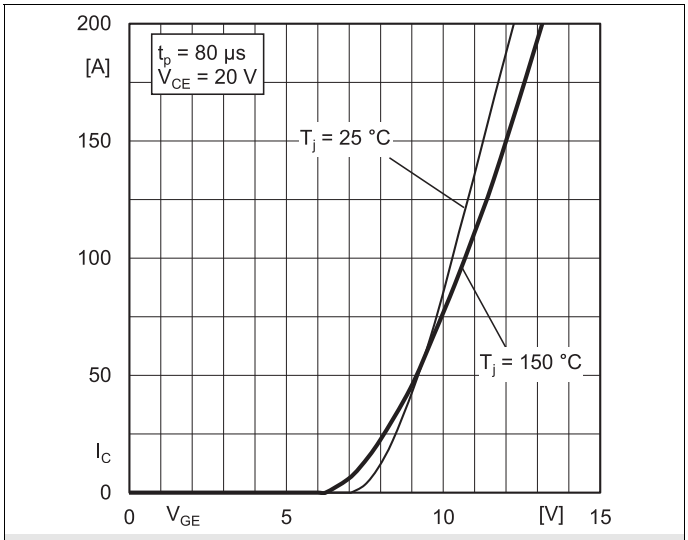



Fig. 5: Typ. transfer characteristic

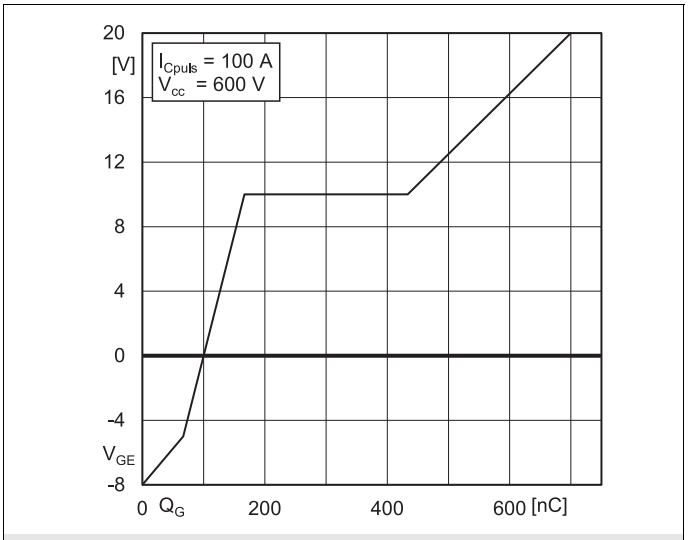



Fig. 6: Typ. gate charge characteristic

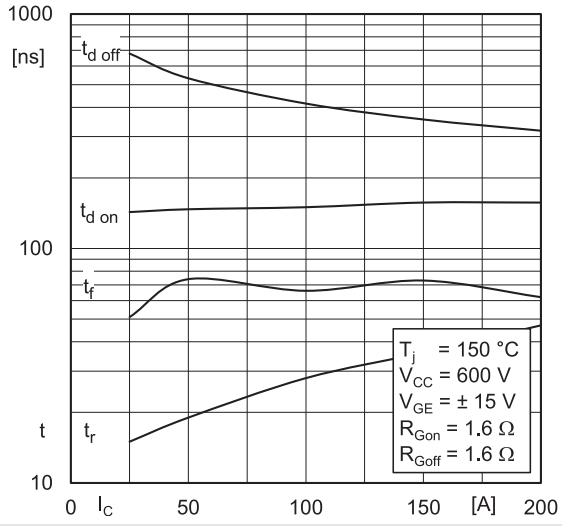



Fig. 7: Typ. switching times vs. $I_C$

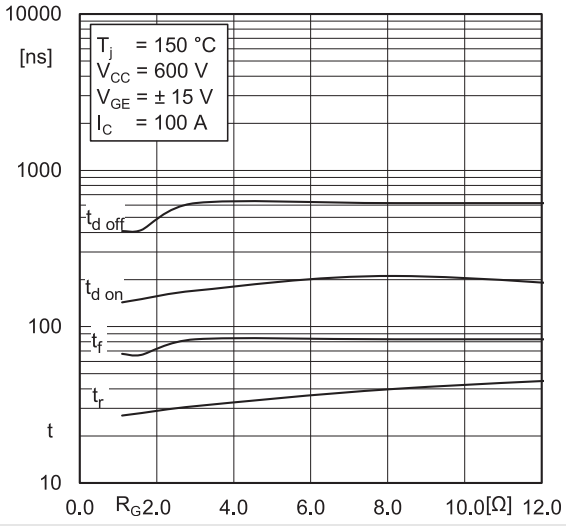



Fig. 8: Typ. switching times vs. gate resistor $R_G$

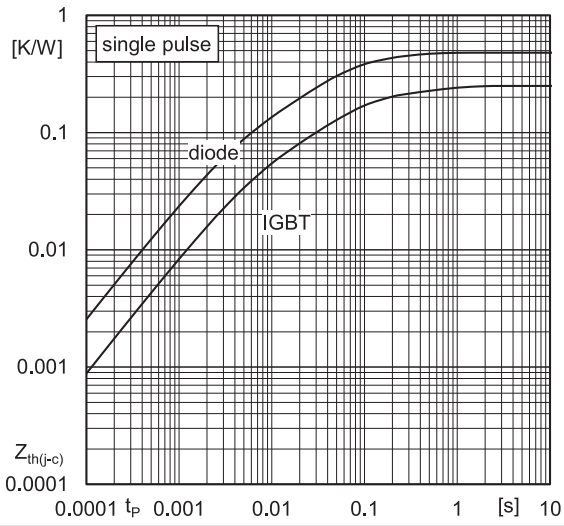



Fig. 9: Transient thermal impedance

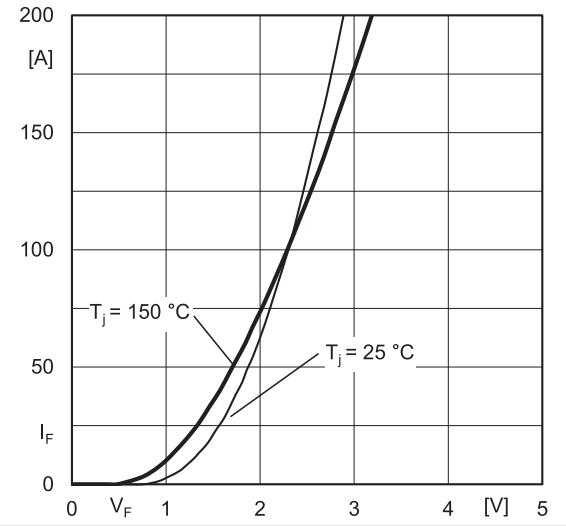



Fig. 10: Typ. CAL diode forward charact., incl. $R_{CC'+EE'}$

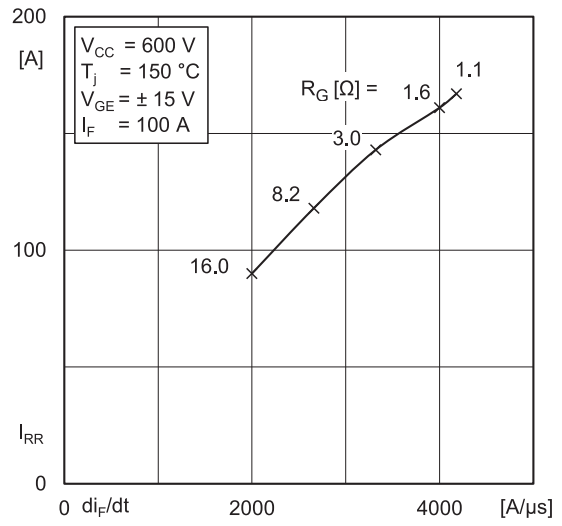



Fig. 11: Typ. CAL diode peak reverse recovery current

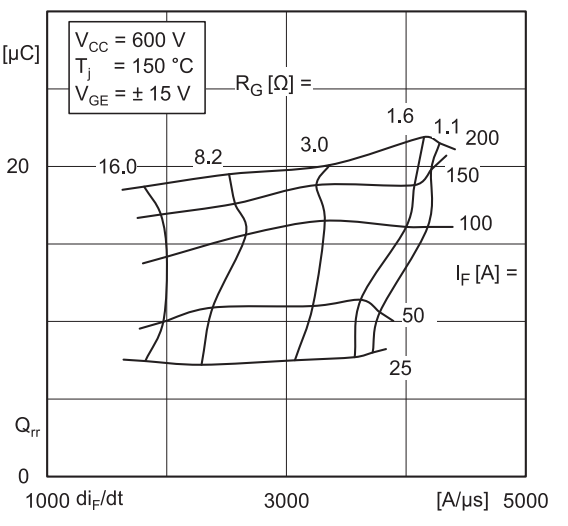
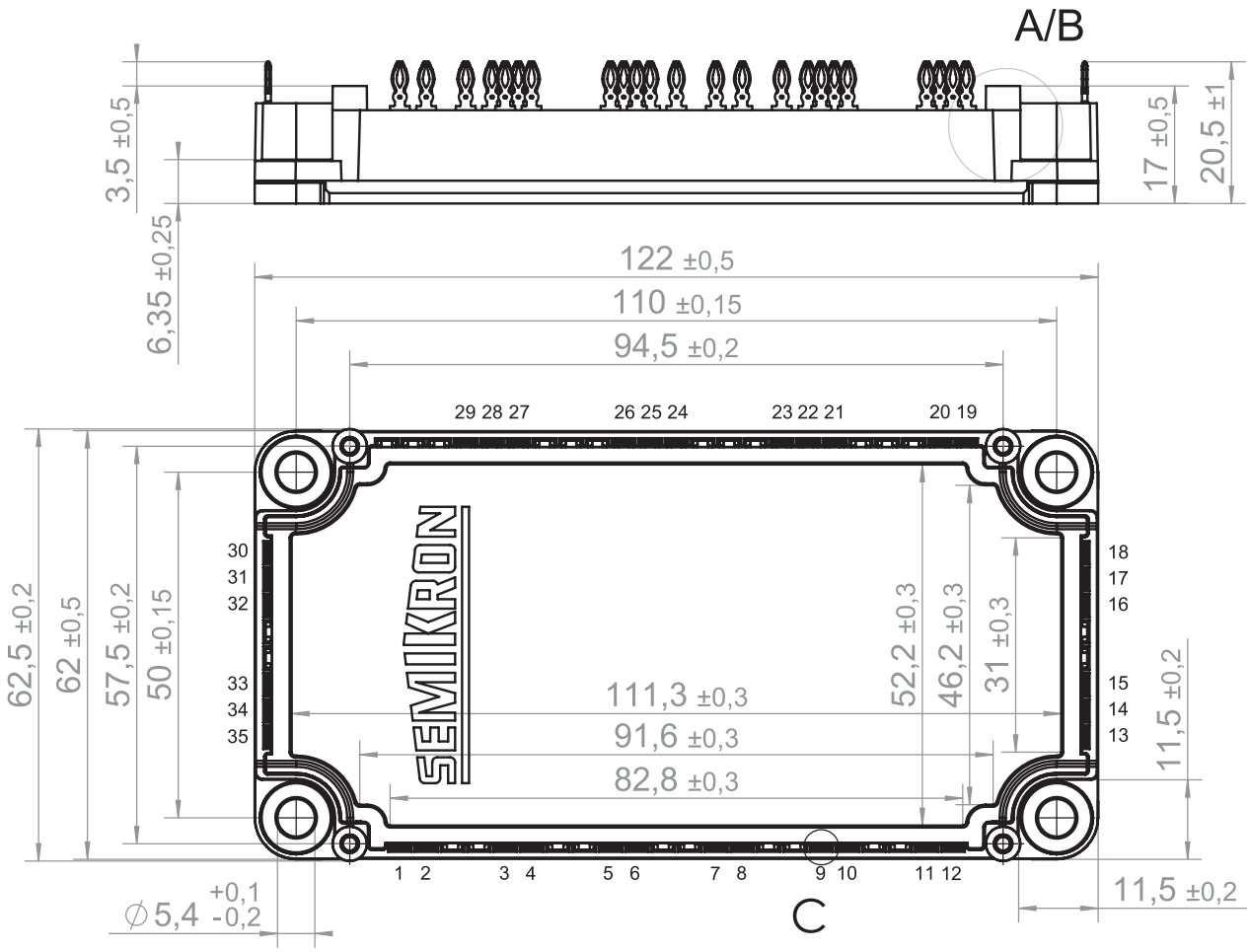
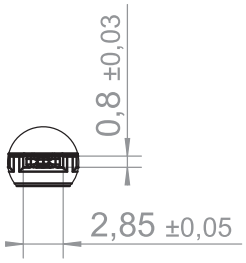


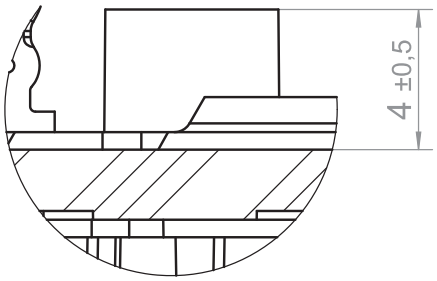

Fig. 12: Typ. CAL diode recovery charge

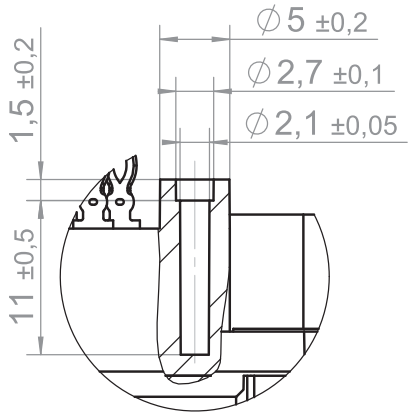


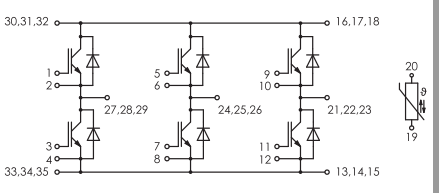

C (2 : 1)



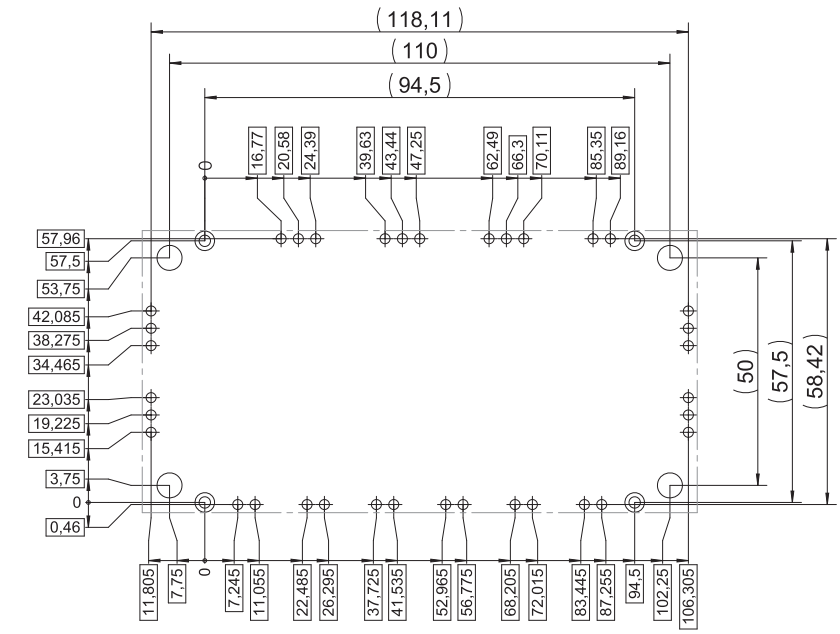

B (5 : 1)
Cross-sectional plane in the middle of the module




A (2 : 1)
Cut-out shows section through the center of the PCB-dome




pinout




This is an electrostatic discharge sensitive device (ESDS), international standard IEC 60747-1, chapter IX.

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